known relating to his subject. The glossary of technical terms which follows the preface will be useful, and there is also a comprehensive introduction of upwards of thirty pages in which the structure is fully described, and clearly illustrated by diagrams. These are points which are frequently too much neglected by entomological authors, but which are of real practical importance. Besides general remarks and a section on structure, the introduction deals with larvæ, vocal organs, sexual dimorphism, food and habits, and classification. The Lamellicornia beetles are mostly vegetable feeders, or dung or carrion beetles, and some of them, like our own cockchafers, are very destructive to grass in the larval stage, and to leaves of trees when mature. Some, chiefly belonging to the groups described in the present volume, inhabit the nests of ants and termites in the larval stage, and are tended by these insects for the sake of their secretions, while the dung and carrion beetles are general scavengers.

The Lamellicornia, as their name implies, are distinguished by their short lamellated antennæ, which may be observed in a well-developed and characteristic form in our common cockchafers. Mr. Arrow recognises three main families, the Scarabæidæ, Passalidæ, and Lucanidæ. The Passalidæ are not European; the Lucanidæ are the stag-beetles. The Scarabæidæ are divided into two smaller divisions, the Pleurosticti, with four subfamilies represented in the Indian fauna, and the Laparosticti, with eight.

The general arrangement of the volume is similar to that adopted in previous volumes of the "Fauna of India," and need not be further commented on here. Eight species are represented on each of the coloured plates.

We congratulate Mr. Arrow on the completion of an excellent piece of work, and hope that entomologists may have reason to be grateful to him for a long series of equally excellent volumes.

W. F. K.

ELECTRIC MOTORS.

Electric Motors. Continuous, Polyphase, and Single-phase Motors: Their Theory and Construction. By Henry M. Hobart. Second edition, entirely re-written, revised, and enlarged. Pp. xxiv+748. (London: Whittaker and Co., 1910.) Price 18*s*. net.

THE first edition of this work appeared in 1904. Since then remarkable advances have been made in electrical engineering. A foremost place in this progress must be given to electric motors, and more especially to that class employing commutators, in connection with both single- and poly-phase alternating currents. Indeed, the electrification of railways has made the variable-speed single-phase motor with a good starting torque indispensable, for at present the single-phase system alone seems to fulfil the requirements of main line electric traction. Also the polyphase induction motor is no longer to retain the great disadvantage in the matter of speed regulation, which makes it inferior to the continuous-current shunt motor, for successful means are now known whereby the speed may be varied economically over a wide range.

Both these problems are discussed in the present edition, and form part of the new material contained therein, but we find the treatment is mainly descriptive and too general to be of much use to anyone seriously engaged in the design or manufacture of these machines. Admittedly the subject is a difficult one, at any rate, more difficult than the design of ordinary continuous-current and induction motors. Nevertheless, in a book on the theory and construction of electric motors room ought to be made for a proper scientific study of these recent developments.

Coming to the other and major part of the book dealing with more or less *standard* motors, we do not find much improvement on the first edition. To a scientific engineer the author's style is too roundabout, illogical, and non-mathematical. A German engineer would probably call it "unpedägogisch." For instance, the author treats the principles of design by means of examples. Surely the classical way of developing formulæ from the theory, followed by practical details, and illustrated by examples, is far better. Nor—to judge from his examples—does the author appear to have kept pace with the times. We can only think that many of the designs, both of continuous- and alternating-current motors, have long since been repudiated by their respective firms.

The methods of calculation advocated by the author are often open to objection, but to cite instances would take us too far, as the list before us is really too long to choose from. We think enough has been said, however, to show that, while appreciating the immense amount of information the writer has collected, we cannot agree he has produced a book which can be regarded as a standard treatise on the theory and construction of electric motors for the use of students or scientifically-trained engineers.

STANLEY P. SMITH.

THE GEOLOGY OF GERMANY.

(1) *Lehrbuch der Geologie von Deutschland. Eine Einführung in die erklärende Landschaftskunde für Lehrende und Lernende.* By Prof. J. Walther. Pp. xv+358. (Leipzig: Quelle and Meyer, 1910.) Price 7.60 marks.

(2) *Geologie von Deutschland und den angrenzenden Gebieten.* By Prof. R. Lepsius. Zweiter Teil, Lief. ii., Das nördliche und östliche Deutschland. Pp. vi+247–548. (Leipzig: W. Engelmann, 1910.) Price 10 marks.

(3) *Geologie von Ostpreussen.* By Prof. A. Tornquist. Pp. vii+231. (Berlin: Gebrüder Borntraeger, 1910.) Price 10 marks.

(1) PROF. WALTHER has been fortunately compelled to write an account of the geology of Germany, in furtherance of the scheme to which he stands committed. He is one of those educational leaders who believe that knowledge of literature and of cosmopolitan science is insufficient for the citizen. The Fatherland itself, *solum patriae*, must be understood in order to be loved. We must not begin and end with arranging minerals in cabinets and pointing

out their technical applications. Let us appeal rather to the country round the pupil's home. We want, says Prof. Walther, a wider opening of doors and windows. He would play, like the famous piper of Hameln, a tune full of the magic of the world. The school must follow him, when the sun reveals the peaks of far-off ranges, and when the wind swirls the dust in clouds across the slopes. It must follow, when the rain furrows the farmlands, and the roaring stream undercuts its trembling banks. Nature is ready to reveal its beauties, small and great, and comparison with other lands will yet increase a love of home.

With such stirring words this vigorous work sets out. The illustrations are almost all from places that the author knows. They have been drawn with brush or pencil by Herr Weszner from photographs and other trivial sources, with an art that seems coarse at first sight, but which grows very quickly on the reader. The painter has understood his author—note the simple desolation of the "Baumfriedhof" among the dunes (p. 5), the cemetery of trees; the renowned quarry of Solenhofen (p. 94), on a plateau above the village, where the level strata appeal so temptingly beyond the woods; or the vivid little sketch (p. 256) of Karlsbad crowded in its ravine; and compare this last with the glimpse of Regensburg (p. 293), seated like an island in the alluvium, as one sees it for the first time in descending from the hills. The essentials are all there, just as in the text, which is pure literature. The geological map, however, is far too severe and uncommunicative. Even the German schoolboy might hesitate before a group of towns named Mü., La., Er., and Rud., in the country east of Eis., which we conclude is Eisenach. The Porta Westfalica is figured, and might well be named; we seek it on the Weser between Ha., the city of the piper, and Mi., probably the place of the "men who fought." We have some acquaintance with the Vistula, and can look with interest on Th., Mbg. (recalling a watergate on the Nogat), and even Di., a railway junction; but we cannot recover Cu. We are writing far away from atlases, and there is no need for so many puzzles in a work that connects geography and geology. But this shall be our only grumble, though we believe that another map on p. 125, full of attractive river courses, is on only one-tenth of the scale ascribed to it. Theoretical questions are not overlooked by the author, when once he has aroused interest in the origins of things. We are brought to contemplate the yielding but sustaining *Untergrund* on p. 28; we gaze on a north pole in the middle of Greenland during the Ice age (p. 113); and we picture intelligent apes using eoliths in the Miocene period (p. 128). Throughout its first two sections the book stands successfully apart from most of our attempts at "nature-study." While we are apt to insist on the beauty of things, Prof. Walther makes us know that they are beautiful by his telling of them. In the third section, he leads us to a closely written description of the origins of German landscape; but we still come across vivid touches that enable us to realise the past. We should like to quote the description (p. 171) of the volcanic cloud caught by westerly winds above the crater of the Laacher See, or the passages that trace the history of the granite tors which rise on the Fichtelgebirge through the woods (pp. 242–3). Teachers will select and enlarge the descriptions of their special areas; but they will learn to adopt a comprehensive view of natural phenomena that will fit them, in Walther's opinion, to live upon this living world.

(2) Prof. Lepsius has carried his great work on the geology of Germany to the end of its second volume, and it remains a storehouse of well-chosen references to original research. Some of these must have found their way into the book almost during its passage through the press. The author was never a mere compiler, and in the present part he adds greatly to the interest of his subject by a full discussion of recent views on the deposits of the north German plain. He holds that there is no doubt as to the advance of ice from Scandinavia over this vast area; but he will not countenance the suggestion of interglacial epochs. The evidence for these he regards as local, and as supporting his belief in prolonged Scandinavian glaciers, rather than in a continuous ice-sheet (p. 477, *et seq.*). He does not accept Greenland as an existing parallel for what occurred in northern Europe, and quotes Schwarz with approval as to the maximum thickness of an ice-flow (p. 475). He sees the cause of the Ice age in geographical conditions, and attributes the Dwyka Conglomerate of South Africa (p. 514) merely to the elevation of a mountain chain. He allows of great movement of blocks of chalk by advancing ice, but does not accept the evidence for plucking action. All this shows that the author's spirit aims far beyond mere description, and that he is quite prepared to champion views which others have set aside. We have dwelt on this part of the book rather than on the fine and detailed description of the Harz area (pp. 286–410), where Prof. Lepsius critically reviews the work of Lossen, on the basis of personal observations. His readiness to adopt new views where he holds them to be justified is never left in doubt, a good example being his treatment of the mingled types of igneous rocks on the margin of the granite of the Harz (p. 350). Nor does he shrink from controversy, when he claims to have converted an eminent colleague (p. 443) to his undoubtedly sound opinions on the famous Saxon granulites. Prof. Lepsius has now furnished us with one of the most serviceable reference books on the geology of Central Europe.

(3) Truly the geologist is happy anywhere. Prof. Tornquist writes on the geology of Ostpreussen with enthusiasm. This remote province, as he justly remarks, is known to few besides those that dwell in it, but to them its very expanse is beautiful. In his handsome volume we learn much stratigraphy from the fossiliferous pebbles that are embedded in the covering of glacial drift. We hear of interesting formations that are reached by borings, and the mantle of clays and sands seems to the student to cover fascinating mysteries. The derived fossils are beautifully illustrated, and the amber, with its included insects, is ascribed mainly to the Lower Oligocene of Samland (p. 98). The discussion of the drift leads

to an account of the oscillations of the margin of the Scandinavian ice, and the formation during a resting epoch of massive terminal moraines. A block of Miocene sediments with undisturbed bedding, including brown coal, and 30 metres thick, has been found at Georgenswalde, as a transported inclusion in the boulder-clay (p. 150). Marine clays with Yoldia and many other molluscs are regarded, in opposition to recent views in Sweden, as older than the maximum extension of the ice. These beds seem, indeed (p. 156), to have been deformed by the pressure of the ice. One great forward movement of the glacier-front, and one retreat, broken by pauses and small oscillations, are held (p. 159) to explain the phenomena in Ostpreussen. During a pause, which Prof. Tornquist explains by the sinking of the ice into yielding glacial deposits in a great depression in the south-east of the province (p. 175), the pre-Glacial marine sands and the earlier ground-moraines are said to have been pressed up as a ridge, just as the growth of the dunes along the northern coast has pressed up modern marine beds out of the sea (*cf.* p. 209). The photographs give vitality and interest to a strange monotonous country, which we well remember, as we crossed it under grey September clouds. The view of Neidenburg (p. 167) reminds us of the gravels washed from the retreating ice, and of the last villages of Prussian Poland, joined by tracks of trampled sand. On this broad outwash plain, the white-capped Cossack riders, night and day, keep the boundary between east and west along the fenceless fields.

GRENVILLE A. J. COLE.

OUR BOOK SHELF.

Orchids. By James O'Brien. Pp. xii+114. (London and Edinburgh: T. C. and E. C. Jack, n.d.) Price 1*s.* 6*d.* net.

IN the preface to this little book it is observed that householders in suburban districts who have but one conservatory may, if they choose, keep it furnished with orchids at a less expenditure of time and money than is needed for the usual occupants of such structures. Frankly, we doubt it. The same thing has been written many a time before and doubtless many a confiding householder has tried to do it, but so far as we can judge the successes are few and far between. The author of this work has devoted his life mainly to the study and cultivation of orchids, and, like most experts, is apt to take for granted a knowledge of certain fundamental principles which for himself require as little consideration as breathing, but which are nevertheless absolutely essential to success. It is over these that the average suburban householder with no special training comes to grief. No doubt it can be done, especially by persons with abundant time on hand, and plenty of enthusiasm; but not by the ordinary City man who has to leave his orchids—their shading and ventilation—to the tender mercies of the jobbing gardener or the occasional attentions of a distracted housemaid from ten to six, the most important part of the day in orchid culture.

But whilst we cannot support the optimistic views as thus expressed by the author, we can strongly recommend his book. It gives a condensed, but wholly admirable, account of the history of orchid cultivation, of the structure of orchid flowers, of the principles of building orchid houses, and the best short account we have yet seen of how to cultivate these plants. Many who have themselves spent years amongst orchids will read the book with profit and pleasure. It is well printed, and is illustrated by eight coloured pictures made from plants grown in the famous collection of Sir G. L. Holford, at Westonbirt. They represent the acme of the orchid cultivator's art.

Practical Mathematics and Geometry. By E. L. Bates and F. Charlesworth. Pp. viii+446. (London: B. T. Batsford, 1910.) Price 3*s.* net.

THIS book has been written with the view of meeting the recent addition to the Board of Education examination syllabus, which unites arithmetic, algebra, and practical drawing under the heading of "Preliminary Practical Mathematics." In deciding the question as to the best teacher for the combined course the following points cannot be ignored. The mathematical teacher as a rule cannot be entrusted to teach draughtsmanship—one of the most important lessons a young technical student has to learn, and one which, if spoiled at the start, is rarely remedied later. On the other hand, the engineering teacher is apt to attempt to specialise in mathematics too early; again, his time is generally fully occupied with his own special work.

The book before us contains 446 pages crowded full of matter presumably considered essential for a first year's evening course. It includes mathematical work up to quadratic and other equations, logarithms and variation, and plane and solid geometry up to the projections of simple solids and their sections. There is little attempt to coordinate the mathematical and drawing work.

Introduction à la Métallographie Microscopique. By Prof. P. Goerens. Edition Française traduite par Prof. A. Corvisy. Pp. 227. (Paris: A. Hermann et Fils, 1911.) Price 10 francs.

THE English translation from the German edition of this work appeared more than two years ago, and was reviewed in NATURE, vol. lxxviii (1908), p. 387. The present book, however, is not identical with any previous issue. It is a careful revision by F. Robin, and is in advance of its predecessors in several respects. The arrangement is somewhat more logical, the description of the measurement of temperature by thermocouples being followed at once by a section devoted to the methods employed in studying the microscopic structure of metals, and the remainder of the book is occupied by an account of the constitution of alloys, illustrated by a very large number of examples. The iron-carbon alloys are dealt with in detail in a separate section. The most important additions of new matter are descriptions of many series of binary alloys, which have been studied during the last three or four years, and a large number of beautiful reproductions of photomicrographs of the structure of metals.

Das Radium und die Farben. By Prof. Dr. C. Doelter. Pp. viii+133. (Dresden: Theodor Steinkopff, 1910.) Price 4 marks.

THIS is a useful summary of the very numerous observations which have been made on the colour phenomena produced in minerals by the neighbourhood of radio-active bodies. Although the facility with which experiments can be made with radium (at least by the fortunate possessor of an adequate specimen of that substance) have given a special prominence to observation made with it, it is well known that analogous colorations are produced by kathode and Röntgen rays, and by ultra-violet light. These subjects are included in the book, which contains a full bibliography.